Spot Safety Project Evaluation

Project Log # 200501207

Spot Safety Project # 02-94-216

Spot Safety Project Evaluation, of the Directional Crossover Installation and Geometric Revisions, At the Intersection of US 264-Greenville Blvd and SR 1523-Whichard Road, Near Greenville, in Pitt County

Documents Prepared By:

Safety Evaluation Group
Traffic Safety Systems Management Section
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_____ 8/9/05
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Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 02-94-216 – The Intersection of US 264-Greenville Blvd and SR 1523-Whichard Road, near Greenville, in Pitt County

Introduction

In an attempt to assess the safety of our roads, the Safety Evaluation Group of the Traffic Safety Systems Management Section has evaluated the above project. The methodologies used in this evaluation offer various philosophies and ideas, in an effort to provide objective countermeasure crash reduction results. A naive before and after analysis and an Odds Ratio comparison analysis have been completed to measure the effectiveness of the spot safety improvement. This information is provided to you so the benefit or lack of benefit for this type of project can be recognized and utilized for future projects.

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasures chosen for the subject location included:

1. Redesigning the existing crossover to a left-over only for westbound vehicles on SR 1523-Whichard Road.

2. Constructing a full lane in the median of US 264-Greenville Blvd from SR 1523-Whichard Road southward (for approx. 1200 feet) to the left-turn lane at the intersection of US 264/ US 264A/ NC 33.

N.C. Crowe, Jr., P.E. originally requested the improvements. Both US 264-Greenville Blvd and SR 1523-Whichard Road have a speed limit of 55 mph. US 264-Greenville Blvd is a four-lane divided roadway with two travel lanes in each direction. A left-turn lane and a right turn lane are also provided on each approach. SR 1523-Whichard Road is a two-lane roadway under stop sign control at the treatment intersection.

According to initial traffic counts, approximately 70 percent of vehicles entering the intersection from westbound SR 1523-Whichard Road made left turn movements. This movement is more than triple the next highest side-road movement. In addition, some vehicles were using westbound SR 1523-Whichard as a shortcut to westbound NC 33. Once vehicles entered the crossover, they proceeded across eastbound US 264-Greenville Blvd through inadequate gaps. Numerous Angle Crashes resulted. The initial crash analysis for this location was completed from February 1, 1992 through January 31, 1995 with a total of 33 reported crashes. There were 27 Angle Crashes, three Rear-End Crashes, and three Left-Turn Crashes. One fatality, two class A injuries, five class B injuries, and 27 class C injuries resulted. The final completion date for the improvement at the subject intersection was on April 30, 1999.

Comparison Analysis

After reviewing the spot safety project file folder along with all the crashes at the subject location, the crash data omitted from this analysis to consider for an adequate construction period was from March 1, 1999 through June 30, 1999. The before period consisted of reported crashes from November 1, 1993 through February 28, 1999 (5 Years, 4 Months) and the after period consisted of reported crashes from July 1, 1999 through October 31, 2004 (5 Years, 4 Months). The ending date for this analysis was determined by the available crash data at the time the crash analysis was completed.

The analysis included two different sets of data, the treatment and the comparison data. The treatment data consisted of all crashes within 150 feet of the subject intersection. The comparison data consisted of all crashes within a 150 feet Y-line on US 264-Greenville Blvd, from 200 feet south of SR 1579-SR 1612 to 0.4 miles north of SR 1523. Please see attached *Location Map* for further detail. The following data table depicts the Naive Before and After Analysis for the treatment and comparison information. Please note that Angle Crashes were the target crashes for the applied countermeasure.

Treatment Information

	Before	After	Percent Reduction (-)/ Percent Increase (+)
Total Crashes	58	16	- 72.4
Total Severity Index	7.44	5.62	- 24.5
Angle Crashes	50	10	- 80.0
Angle Severity Index	8.03	6.92	- 13.8
Volume	19,600	22,000	12.2

Comparison Information

	Before	After	Percent Reduction (-)/ Percent Increase (+)
Total Crashes	54	54	0.0
Total Severity Index	8.23	5.25	- 36.2
Angle Crashes	21	12	- 42.9
Angle Severity Index	16.06	5.93	- 63.1
Volume	14,200	16,500	16.2

Odds Ratio: Treatment versus Comparison

	Before	After	Percent Reduction (-)/ Percent Increase (+)
Treatment Total Crashes	58	16	---
Comparison Total Crashes	54	54	- 72.4 %

The naive before and after analysis at the treatment location resulted in a 72.4 percent decrease in Total Crashes, a 24.5 percent decrease in the Total Severity Index, and a 12.2 percent increase in Average Daily Traffic (ADT). The comparison location experienced a 0.0 percent increase in Total Crashes, a 36.2 percent decrease in the Total Severity Index, and a 16.2 percent increase in ADT. The before period ADT year was 1996 and the after period ADT year was 2002.

The Odds Ratio is used as another means of calculating the treatment effect. The number of crashes in the before and after period from the Comparison Strip are used to calculate the percent reduction in crashes for the Treatment Intersection. As shown in the previous table, using the Odds Ratio calculation, there is a 72.4 percent decrease in Treatment Intersection crashes.

Additional Analysis

In order to test for crash migration, a naïve before and after analysis was also performed at two intersections effected by the spot safety improvements. The two intersections analyzed are as follows: US 264-Greenville Blvd at NC 33/ US 264A and NC 33 at SR 1523-Whichard Road/ SR 1534-Old Pactolus Road. US 264-Greenville Blvd at NC 33/ US 264A is a signalized intersection. NC 33 at SR 1523-Whichard Road/ SR 1534-Old Pactolus Road is stop sign controlled. The data consisted of all crashes within a 150 feet Y-line of both intersections. In addition, crashes specifically involving movements influenced by the treatment countermeasures were identified and analyzed. Please see the attached *Aerial photograph,* which provides a visual representation of those movements prohibited and those influenced by the spot safety improvements. The following table is a summary of crashes potentially influenced by the treatment.

Overall Crash Summary of Treatment Influence Area

	Before	**After**	**Percent Reduction (-)/ Percent Increase (+)**
Treatment Intersection	58	16	- 72.4 %
NC 33 at SR 1523/ SR 1534			
Total Crashes	21	13	- 38.1 %
RT Turn From/ LT Onto SR 1523	2	1	- 50.0 %
Volume	10,600	8600	- 18.9 %
US 264 at NC 33/ US 264A			
Total Crashes	71	88	23.9 %
LT From EB NC33 Onto NB US 264	2	9	350.0 %
U-turn From SB US 264	2	2	0.0 %
Volume	34,500	33,500	- 2.9 %

As shown above, the naïve before and after analysis at the intersection of NC 33 at SR 1523-Whichard Road/ SR 1534-Old Pactolus Road resulted in a 38.1% decrease in Total Crashes. The naïve before and after analysis at the intersection of US 264-Greenville Blvd at NC 33/ US 264A resulted in a 23.9% increase in Total Crashes.

Because SR 1523-Whichard Road was used as a shortcut to westbound NC 33 prior to the directional crossover, crashes involving right-turn movements from westbound SR 1523-Whichard Road and left-turn movements onto eastbound SR 1523-Whichard Road from NC 33 were examined. The number of crashes involving these movements had the potential to decrease after the directional crossover cut off through movements on SR 1523-Whichard Road. The crash analysis revealed that the effects were minimal. Only two crashes in the before period and one crash in the after period involved vehicles making these maneuvers.

The number of crashes involving left-turn movements from eastbound NC 33 onto northbound US 264-Greenville Blvd and right-turn movements from southbound US 264-Greenville Blvd onto westbound NC 33 were also examined. These crashes had the potential to increase because vehicles that previously used SR 1523-Whichard Road as a cut-through must now travel to the intersection of US 264 at NC 33 and US 264A. The number of crashes involving left-turn movements from eastbound NC 33 onto northbound US 264-Greenville Blvd increased from two crashes in the before period to nine crashes in the after period. There were no crashes involving right-turn movements from southbound US 264-Greenville Blvd. In addition, possible U-turn crashes from southbound vehicles on US 264-Greenville Blvd were examined. These crashes also had the potential to increase in the after period because of the movements prohibited at the treatment location. Possible U-turn crashes involved either Rear-End Crashes in the left-turn lane or involved conflict between left-turning vehicles and right turning vehicles on westbound US 264. There was no increase in the number of crashes involving U-turns from southbound US 264.

Results and Discussion

The naive before and after analysis at the Treatment Intersection resulted in a 72.4 percent decrease in Total Crashes and an 80.0 percent decrease in Angle Crashes. Using the Odds Ratio to calculate the treatment effect resulted in a 72.4 percent decrease in Total Crashes at the Treatment Intersection. The summary results above demonstrate that the treatment location appears to have had a substantial decrease in the number of Total and Angle Crashes from the before to the after period. The Total Severity Index also decreased by 24.5 percent from the before to the after period. The number of Class A injuries decreased from two in the before period to none in the after period. The number of Class B and class C injuries also decreased by 69.2 percent and 63.1 percent, respectively. Although the number and severity of crashes has decreased dramatically, note that a pattern of Angle Crashes between northbound and westbound vehicles still persists at the treatment location.

The naïve before and after analysis of the intersections to the south and west of the treatment location displayed mixed results. The intersection of NC 33 at SR 1523-Whichard Road and SR 1534-Old Pactolus Road experienced a 38.1 percent decrease in Total Crashes. The intersection of US 264-Greenville Blvd at NC 33 and US 264A experienced a 23.9 percent increase in Total Crashes. Differences in the number of crashes from the before to the after period for the

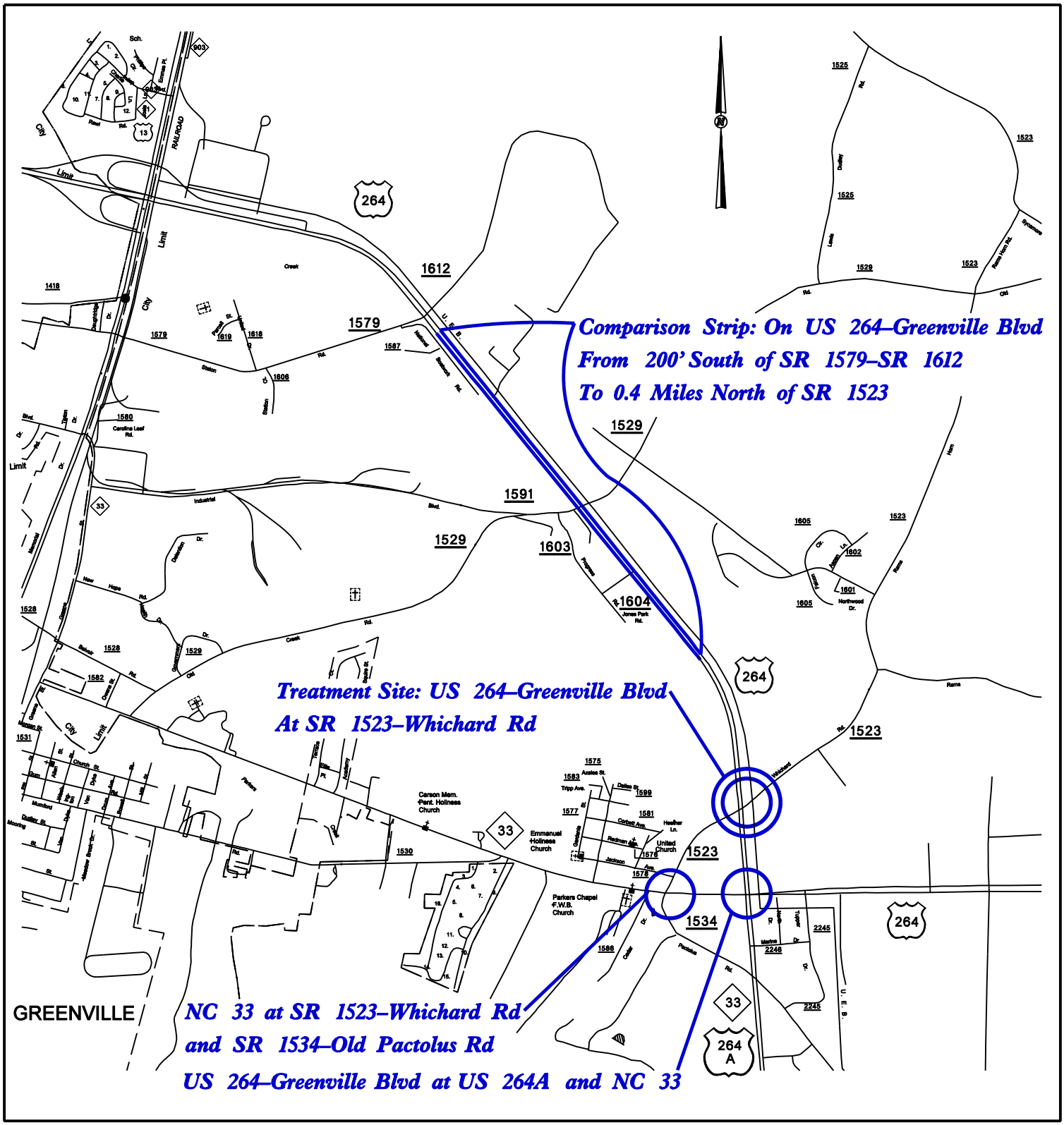
surrounding intersections may be (at least partially) attributed to the installation of the directional crossover at the treatment location. The raised islands constructed in the crossover prevent through movements for both side street approaches and left-turn movements for the eastbound side street approach. Motorists wishing to make these movements need to find an alternative route (i.e. potential crash migration occurs). Therefore, the effect of the treatment on surrounding intersections must remain in consideration while assessing analysis of the Treatment Intersection.

The section of US 264-Greenville Blvd from 150 feet south SR 1523-Whichard Road to 150 feet north of US 264/ US 264A/ NC 33 was also analyzed. A full lane in the median of US 264-Greenville Blvd was constructed as part of the spot safety project from SR 1523-Whichard Road southward to the existing left-turn lane. While performing the site investigation, several "near-misses" (i.e. potential Rear-End or Sideswipe Crashes) occurred between southbound US 264 vehicles and vehicles merging from the crossover. However, analysis of crashes in this section revealed that the number of Rear-End Crashes between southbound vehicles only increased from four crashes in the before period to five crashes in the after period. Also, there were no reported Sideswipe, Same Direction Crashes within this section in either the before or after period.

Please see the attached *Treatment Site Location Photos*. Photos are provided for each leg of the treatment intersection. In addition, photos taken at the intersection of NC 33 at SR 1523/ SR 1534 and the intersection of US 264 at NC 33/ US 264A are provided.

The countermeasure crash reduction for Total Crashes at the subject intersection is a 72.4 percent decrease in crashes. The countermeasure crash reduction for Angle Crashes at the subject intersection is an 80.0 percent decrease in crashes. As the Safety Evaluation Group completes additional spot safety reviews for this type of countermeasure, we will be able to provide objective and definite information regarding actual crash reduction factors.

Evaluation of Spot Safety Project Number 02–94–216
Location Map, Near Greenville, Pitt County



location map.dgn 11/03/2005 08:58:31 AM

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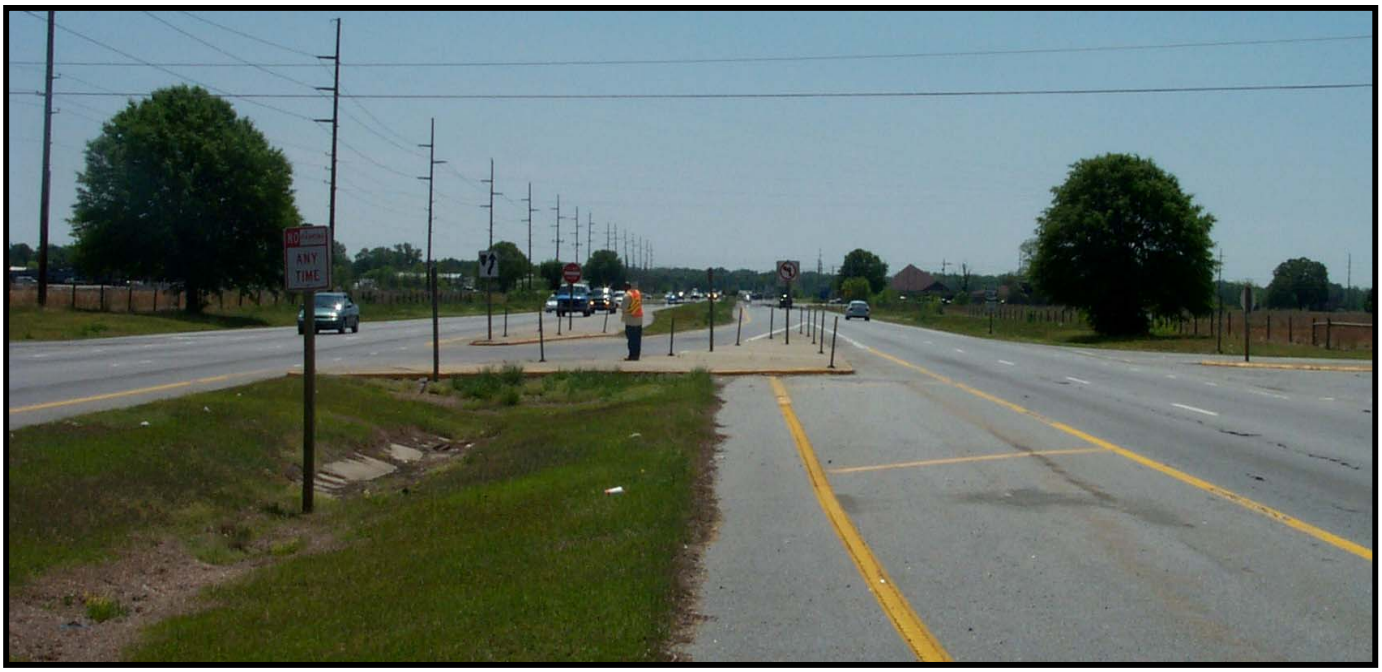
Treatment Site Photos (Taken on May 3, 2005)

Looking north on US 264 – Greenville Blvd



Looking south on US 264 – Greenville Blvd

Treatment Site Photos (Taken on May 3, 2005)

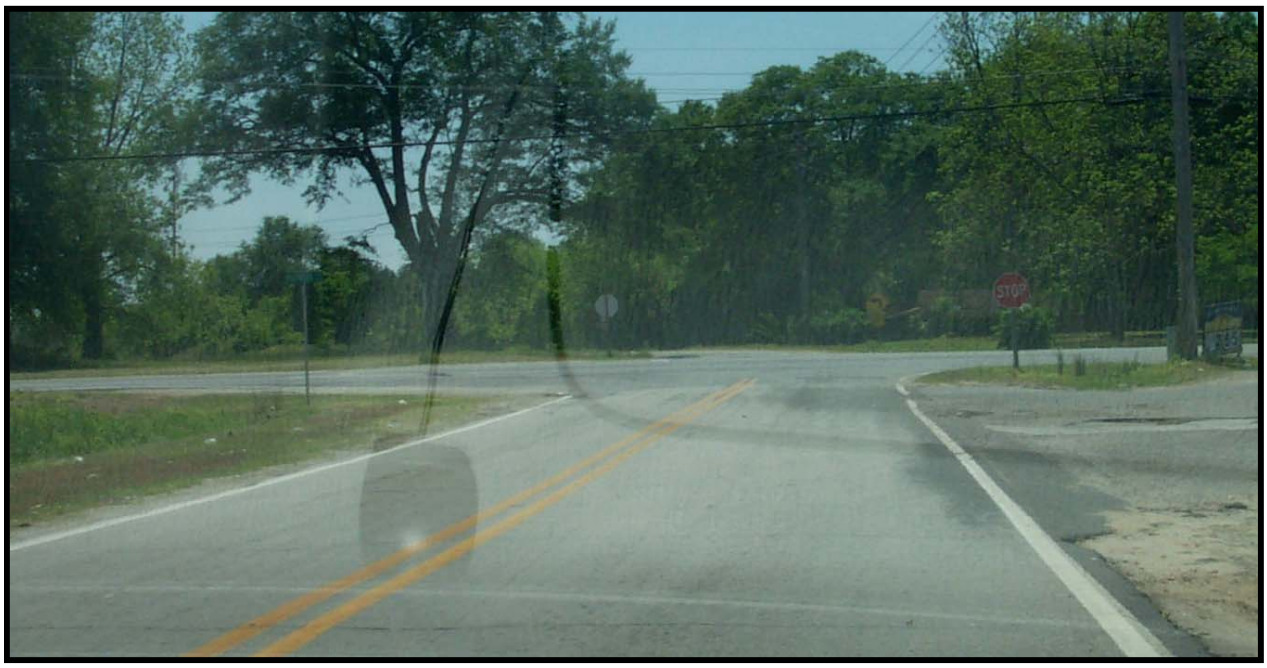
Looking east on SR 1523 – Whichard Road

Looking west on SR 1523 – Whichard Road

Treatment Site Photos (Taken on May 3, 2005)

Additional photo of the directional crossover and lane constructed in the median,
Looking south towards the intersection of US 264 and NC 33.

Treatment Site Photos (Taken on May 3, 2005)

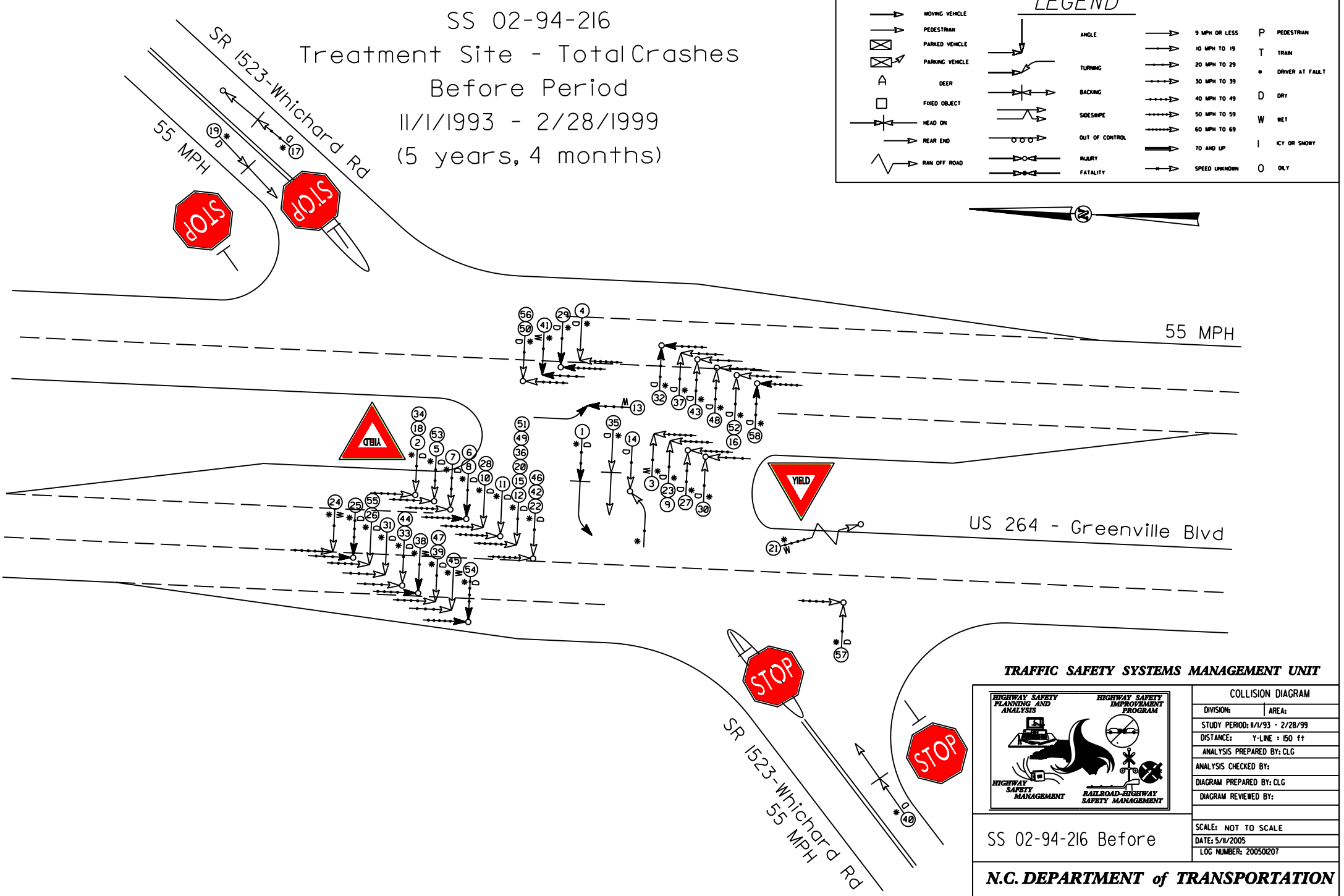


Photos taken at the intersection of NC 33 at SR 1523-Whichard Rd / SR 1534-Old Pactolus Rd.
Top: Driving southwest on SR 1523-Whichard Rd
Bottom: Driving east on NC 33

Treatment Site Photos (Taken on May 3, 2005)

Photos taken at the intersection of US 264 at US 264A/ NC 33.
Top: Driving south on US 264
Bottom: Driving east on NC 33

SS 02-94-216
Treatment Site - Total Crashes
Before Period
11/1/1993 - 2/28/1999
(5 years, 4 months)



LEGEND

MOVING VEHICLE
PEDESTRIAN
PARKED VEHICLE
PARKING VEHICLE
DEER
FIXED OBJECT
HEAD ON
REAR END
RAN OFF ROAD

ANGLE
TURNING
BACKING
SIDESWIPE
OUT OF CONTROL
INJURY
FATALITY

9 MPH OR LESS
10 MPH TO 19
20 MPH TO 29
30 MPH TO 39
40 MPH TO 49
50 MPH TO 59
60 MPH TO 69
70 AND UP
SPEED UNKNOWN

P PEDESTRIAN
T TRAIN
* DRIVER AT FAULT
D DRY
W WET
I ICY OR SNOWY
O ONLY

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

HIGHWAY SAFETY PLANNING AND ANALYSIS
HIGHWAY SAFETY IMPROVEMENT PROGRAM
HIGHWAY SAFETY MANAGEMENT
RAILROAD-HIGHWAY SAFETY MANAGEMENT

COLLISION DIAGRAM

DIVISION:	AREA:
STUDY PERIOD: 11/1/93 - 2/28/99	
DISTANCE: Y-LINE = 150 ft	
ANALYSIS PREPARED BY: CLG	
ANALYSIS CHECKED BY:	
DIAGRAM PREPARED BY: CLG	
DIAGRAM REVIEWED BY:	
SS 02-94-216 Before	SCALE: NOT TO SCALE
	DATE: 5/11/2005
	LOG NUMBER: 20050207

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY SYSTEMS BRANCH

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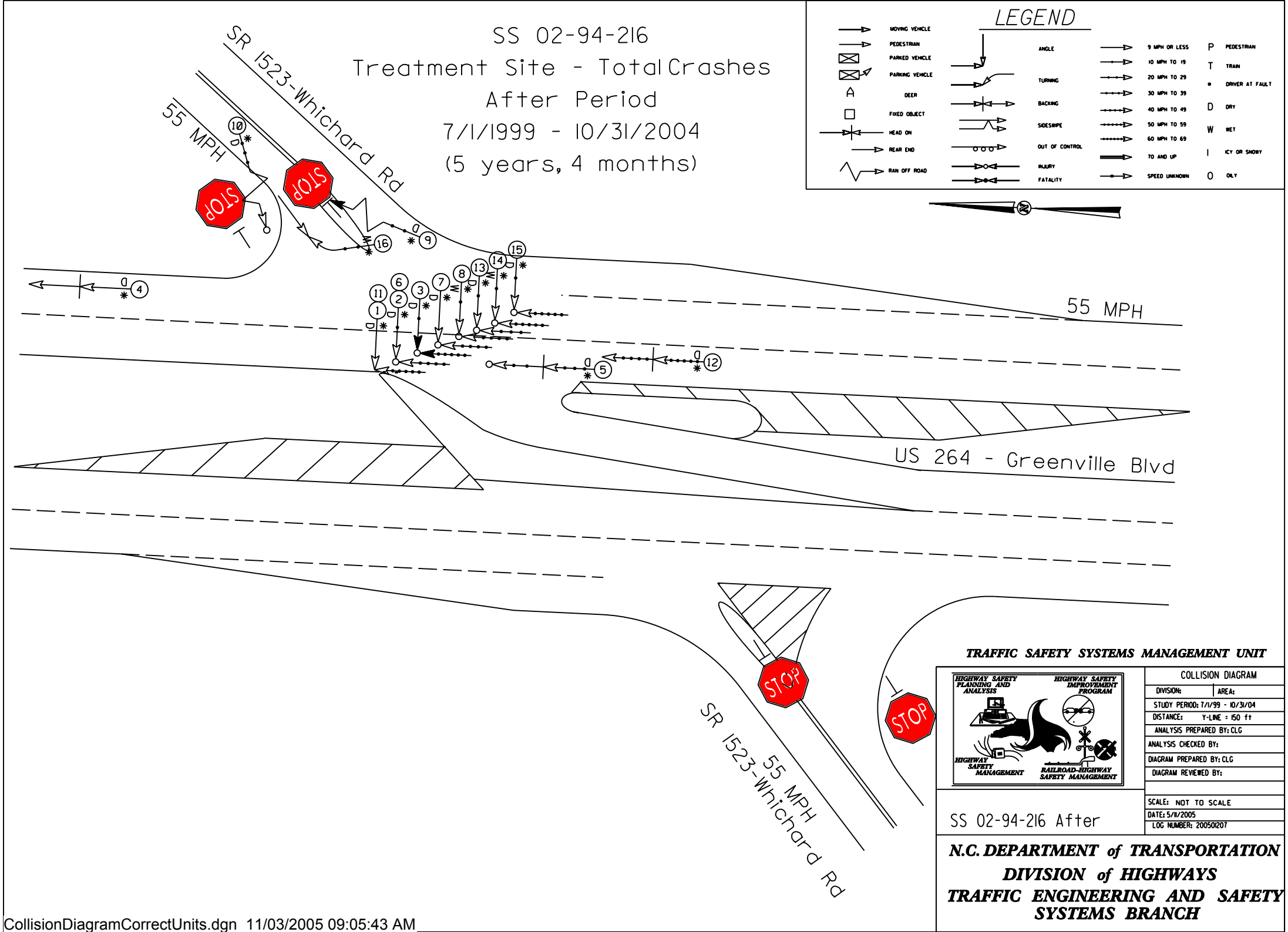
SS 02-94-216
Treatment Site - Total Crashes
After Period
7/1/1999 - 10/31/2004
(5 years, 4 months)
LEGEND
MOVING VEHICLE
PEDESTRIAN
PARKED VEHICLE
PARKING VEHICLE
DEER
FIXED OBJECT
HEAD ON
REAR END
RAN OFF ROAD
ANGLE
TURNING
BACKING
SIDESWIPE
OUT OF CONTROL
INJURY
FATALITY
9 MPH OR LESS
10 MPH TO 19
20 MPH TO 29
30 MPH TO 39
40 MPH TO 49
50 MPH TO 59
60 MPH TO 69
70 AND UP
SPEED UNKNOWN
P PEDESTRIAN
T TRAIN
DRIVER AT FAULT
D DRY
W WET
I ICY OR SNOWY
O OIL
SR 1523-Whichard Rd
55 MPH
US 264 - Greenville Blvd
STOP
TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT
HIGHWAY SAFETY PLANNING AND ANALYSIS
HIGHWAY SAFETY IMPROVEMENT PROGRAM
HIGHWAY SAFETY MANAGEMENT
RAILROAD-HIGHWAY SAFETY MANAGEMENT
COLLISION DIAGRAM
DIVISION:
AREA:
STUDY PERIOD: 7/1/99 - 10/31/04
DISTANCE: Y-LINE = 150 ft
ANALYSIS PREPARED BY: CLG
ANALYSIS CHECKED BY:
DIAGRAM PREPARED BY: CLG
DIAGRAM REVIEWED BY:
SCALE: NOT TO SCALE
DATE: 5/11/2005
LOG NUMBER: 20050207
SS 02-94-216 After
N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY SYSTEMS BRANCH
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